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FIRE

in the United States

1985–1994

NINTH EDITION

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National Fire Data Center

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The United States Fire Administration greatly appreciates the participation in the National Fire Incident Reporting System (NFIRS) of nearly 14,000 fire departments across the United States. The NFIRS data, on which the bulk of this report is based, are available through the work of the staffs of the various state agencies and state fire marshal's offices responsible for fire data collection and on each and every fire officer who fills out an NFIRS form. Without their painstaking efforts to collect data, this report could not exist. Although the NFIRS is wholly voluntary, the information collected on nearly one million fires each year represents the most comprehensive set of fire data and statistics in the world.

The National Fire Information Council (NFIC), a nonprofit organization of the state and metro participants in NFIRS, helps coordinate and specify requirements for NFIRS and its operation. They represent an outstanding example of local, state, and federal cooperation on a major, long-term undertaking.

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EXECUTIVE SUMMARY

Fire kills thousands of Americans each year, injures hundreds of thousands, destroys billions of dollars in property, and costs tens of billions of dollars overall, but mayors and city managers, school officials, the media, and the general public still are largely unaware of the magnitude of these numbers. Their lack of awareness and failure to realize the seriousness of fire to communities and the country are factors in keeping the U.S. fire problem one of the worst in the world per capita.

PURPOSE AND SCOPE

This report is designed to arm the fire service and others with a statistical overview of the fire problem that can motivate corrective action. It can also be used to select priorities and help target fire programs, serve as a model for state or local analyses of fire data, and provide a baseline for evaluating programs.

This Ninth Edition of *Fire in the United States* covers the 10-year period from 1985 to 1994, with emphasis on 1994—the most recent year for which complete data are available at the time of printing. The primary source of data in this report is the National Fire Incident Reporting System (NFIRS), but National Fire Protection Association (NFPA) annual survey results and data from the state fire marshals are also used.

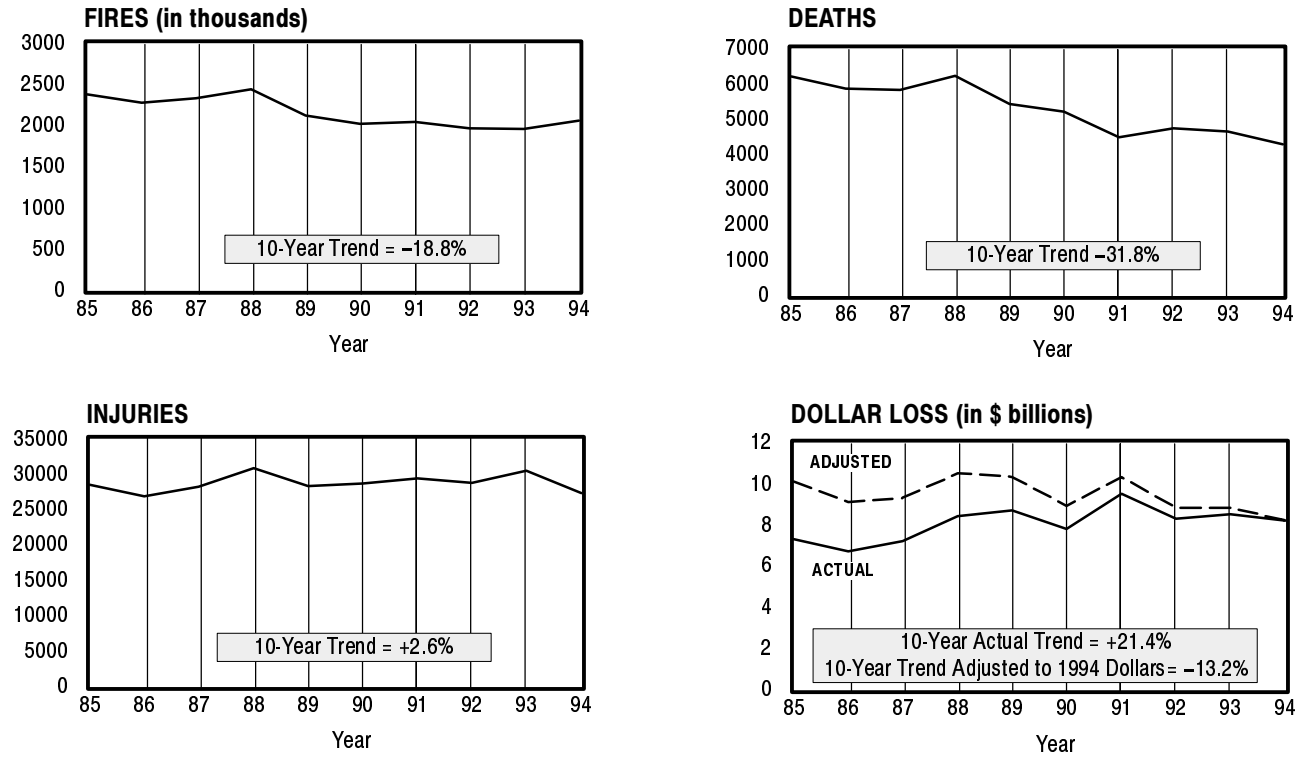
Because of the time it takes to collect data from nearly the 14,000 fire departments that participate in NFIRS, edit and obtain corrections, and analyze and display the results, the date of publication lags the date of collection.

Previous editions of *Fire in the United States* have included a state-by-state analysis and presentation of state fire statistics. This chapter has been omitted from this edition. Instead, a separate volume will be published later in 1997 that is devoted entirely (and more exhaustively than in the past) to state fire profiles.

THE NATIONAL FIRE PROBLEM

Figure 1 summarizes the national fire problem to civilians.[1] During the 10-year period 1985–1994, there were an average of 5,300 civilian fire deaths, 29,000 civilian injuries, and $9.4 billion dollar loss (adjusted to 1994 dollars) from reported fires each

[1] See page 25 for a discussion of how trend percentages were calculated.



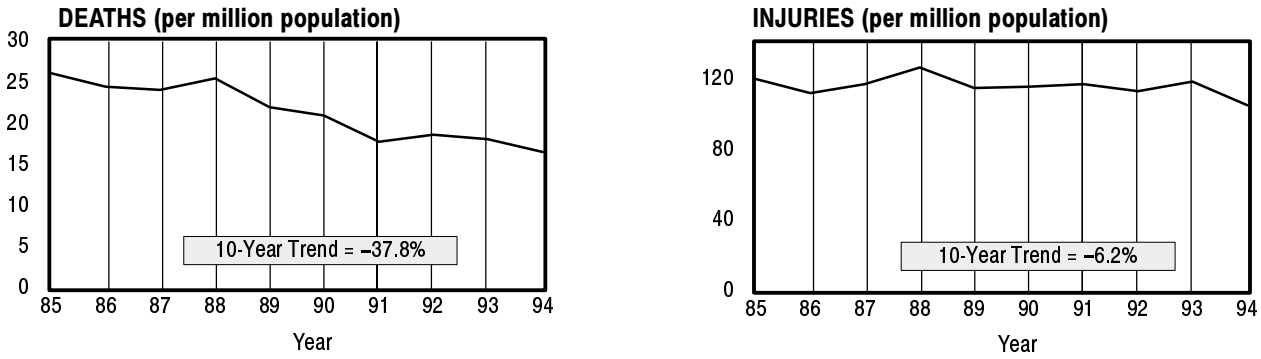
Sources: NFPA Annual Surveys and Consumer Price Index

Figure 1. Trends in Fires and Fire Losses

year. The United States had an average of 2.2 million reported fires annually during this period.

The trend over the past 10 years in the number of fires reported to the fire service has decreased 19 percent, with a noticeable drop in 1989 and continuing modest declines until 1994 when the number of fires increased to the 1991 level. Civilian deaths from fire have dropped sharply over this period (32 percent). Civilian injuries have remained steady over 10 years. The magnitude or trend of injuries from unreported fires is not known. In terms of constant (1994) dollars, losses were down a significant 13 percent over the period—much less than the rise in inflation.

On a per capita basis, the fire problem is less severe in 1994 than it was 10 years earlier, because the population increased faster than did fires and fire casualties (Figure 2). The per capita fire death trend was down 38 percent, and the per capita injury trend was down 6 percent. Although the death rate per fire in the United States has improved greatly, it remains much higher than the yearly reported fire death rates in countries such as Australia, Japan, Hong Kong, and most of the countries in Western Europe.



Sources: NFPA Annual Surveys, Consumer Price Index, and Bureau of the Census

Figure 2. Trends in Severity of Casualties

Regional Variations

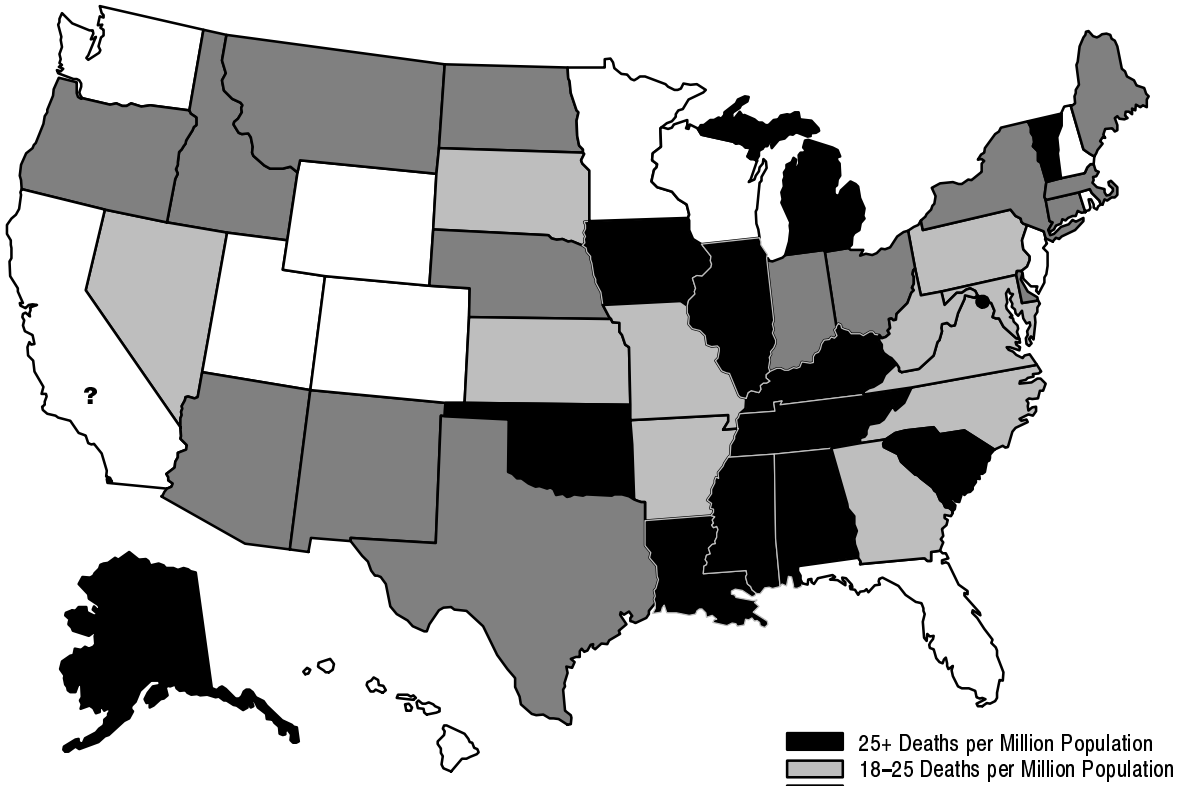
The fire problem varies from region to region and state to state because of variations in climate, poverty, education, demographics, and other factors. The Figure 3 map shows that the fire death rate per capita is highest in the Southeast and a few isolated states. The highest death rates in 1994 were in Alaska, Mississippi, District of Columbia, and Kentucky; Alaska and Mississippi were also ranked in the top five in 1990. States with the lowest fire death rates were Hawaii, New Mexico, Utah, and New Hampshire; none of these states ranked in the lowest five in 1990.

Another important measure to examine is the absolute number of fire deaths in each state. The 11 states with the most fire deaths account by themselves for half of the national total. As expected, large-population states are at the top of this list. National totals cannot be reduced significantly unless these states reduce their fire problem.

Even though the death rate varies, the leading causes of fires (cooking, heating, and arson) and fire deaths (careless smoking, heating, and arson) are relatively similar around the nation. The rank order and magnitude of these causes vary from state to state and by whether fires, deaths, or injuries are used as the measure. Therefore, the priorities for prevention programs must be tailored to location and purpose.

Where Fire Losses Occur

The public generally does not appreciate the magnitude of the fire problem in the home nor the importance of doing its share to reduce fires in the home. Based on 1994 data, the vast majority of our civilian fire deaths (71 percent) and injuries (68 percent) continue to occur in residences, although residences have only 22 percent of the total



Note: Data from California are incomplete.

Sources: State Fire Marshals and the United States Fire Administration

Figure 3. Fire Death Rate by State in 1994

fires (Figure 4). More than two-thirds of injuries incurred by firefighters are in residences. And residences account for a substantial portion of the dollar loss, 44 percent. The 10-year trend mirrors the 1994 picture.

One- and two-family dwellings—where the majority of people in the United States live—dominate the fire problem. They account for 70 percent of all residential fires, 69 percent of deaths, 60 percent of injuries, and 73 percent of dollar loss. Apartments are a large category too, accounting for 32 percent of the residential injuries and 19–23 percent of the other residential fire problems. People continue to underestimate the fire problem potential in their home because large fires in hotels, high-rise office buildings, and other public buildings receive higher media attention than fires in single-family homes.

Often overlooked or ignored in the discussion of residential fires is the effect of fires in garages. In 1994, there were 17,100 fires, or 5 percent of the total in dwellings. Residential garages are coded as storage properties rather than residential properties. This method of coding garage fires has not distorted the residential fire profile in any significant way, but it does lead to understating the fire problem by 1 to 5 percent.

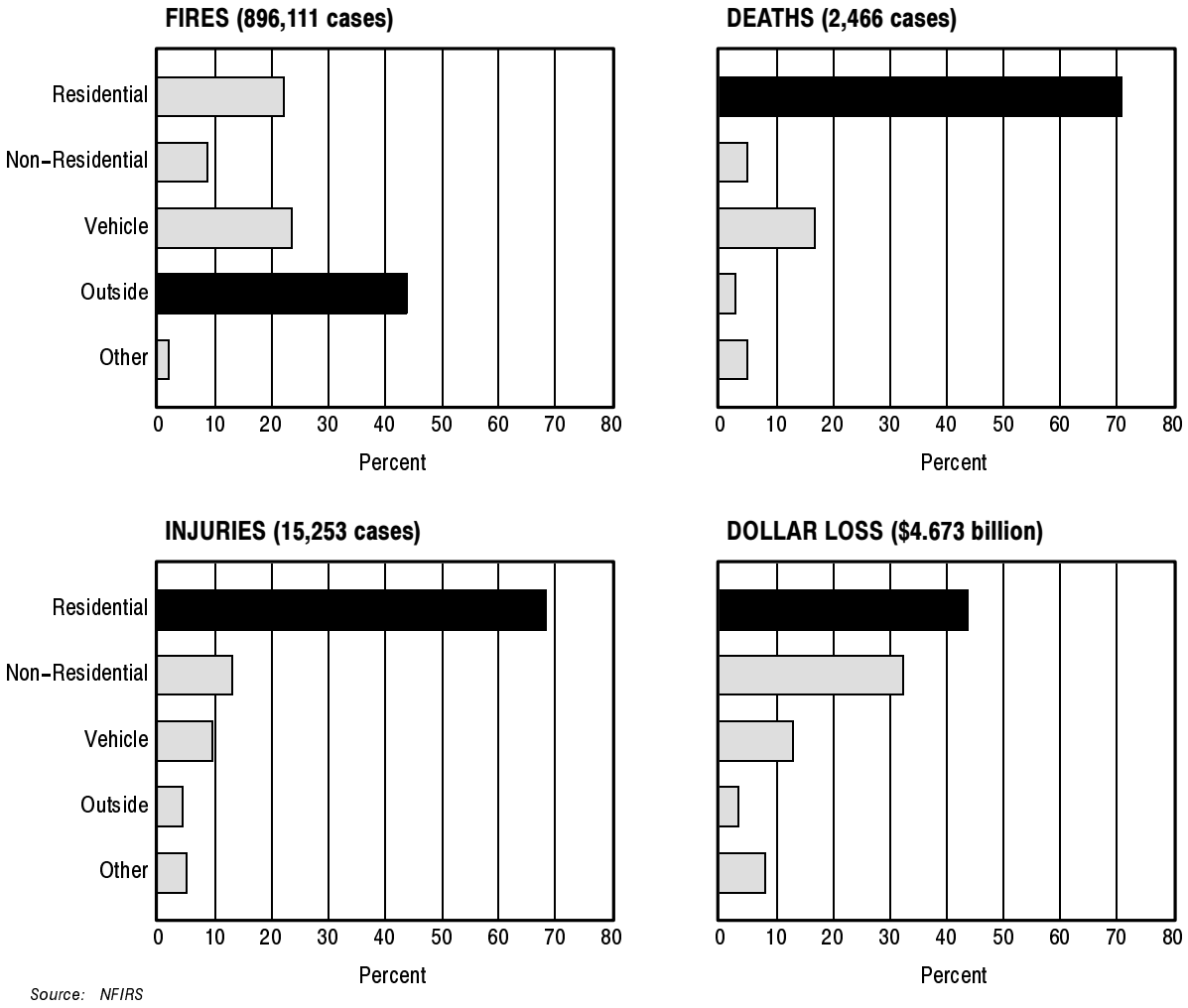


Figure 4. 1994 Fires and Fire Losses by General Property Type

The type of residence that is most dangerous when fire occurs is manufactured housing (mobile homes), where deaths per fire are double that of other types of residences. Hotel/motel fires account for only 1 to 2 percent of the residential fire problem in the various measures, although they tend to get a disproportionately large share of press attention when they occur.

Fires that occur outside (e.g., fields, vacant lots, wildland) are nearly double the number in any other property category, but these fires cause the fewest deaths, injuries, and dollar loss. Many of these fires to which fire departments respond are intentionally set but result in relatively little damage. Outside fires, however, are cause for concern because they may spread to structures.

One of every four calls to fire departments is to respond to a vehicle fire. The topic of vehicle fires is discussed in more detail in a separate section of this chapter.

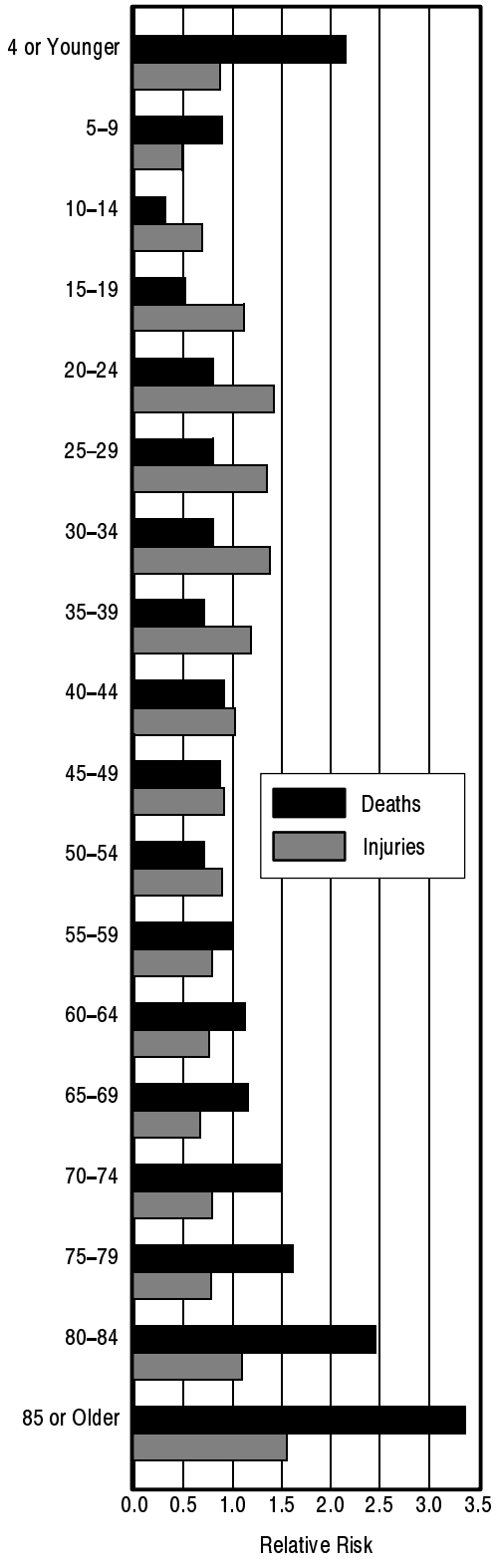
Who Dies or Gets Injured

The elderly and the very young are the groups at highest risk. Children under 5 years of age continue to have double the national average fire death rate (Figure 5). Risk of fire death drops off sharply for children between 5 and 19, then increases slowly with age. The elderly—people over 70—have one-and-one-half to three times the national average fire death rate, depending on how old they are, with the risk increasing sharply for people over 80. However, two-thirds of the people who die in fires are neither very young nor old; the fire problem affects all age groups.

The risk of fire injury peaks at ages 20–24. Young adults have 40 percent greater risk than average. They tend to be involved in the more dangerous activities, especially involving flammable liquid and demonstrating a higher degree of bravado. People over 85 also have sharply elevated risk of fire injury.

Men are twice as likely to be killed in fires than women in 1994, a proportion that has remained relatively stable over the past 10 years. This is true for virtually every age group and has been reported every year since NFIRS started in 1975. Males also have a higher fire death rate per capita than females for all age groups except 15–19-year old females. For some age groups, the male rate is triple the female rate. Elderly men have a significantly higher fire death rate than elderly women. The male/female ratio for fire deaths is almost identical to that for fire injuries.

The reasons for the differences between the sexes in fire risk are not known for sure. Some reasons advanced are the greater likelihood of men being highly intoxicated, the more dangerous occupations of men (most industrial fire fatalities are males), the greater use of flammable liquids by men, their greater likelihood of attempting to fight fires or going back to rescue someone, or possibly that men are less safety-conscious than women.



Sources: NFIRS, NFPA Annual Surveys, and Bureau of the Census

Figure 5. Relative Risk of 1994 Fire Casualties by Age

The fire problem cuts across all ethnic, economic, and regional groups. It is higher for some than for others. For example, people in rural areas and large cities have higher fire death rates than people in mid-size communities. The poor, too, suffer a disproportionate share of deaths versus the rest of the population.

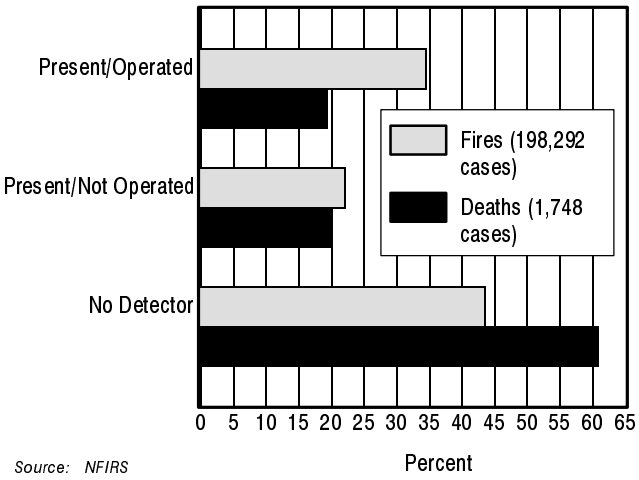


Figure 6. Smoke Detector Performance in 1994 Residential Fires and Fire Deaths (Adjusted)

Smoke Detectors and Sprinklers

In two-thirds of household fires where the information on detectors was reported for 1994, either there was no detector or the detector did not operate (Figure 6).[2] Homes that have reported fires are less likely to have smoke detectors than the homes that do not have fires. That is, detectors are found least often in the places that need them most. Also, 22 percent (adjusted) of the installed detectors in residential fires did not operate. This does not include the situations where the fire was reported as too small to trigger the detector. Usually, detectors do not work because they have no working battery or they have been deliberately disconnected. The increasing trend of nonoperating detectors over 10 years (nearly doubling) is disturbing. A major thrust should be given to educating the populace as to the value of detectors in saving lives.

Detectors are present in a smaller proportion of houses that have fires than in apartments (57 vs. 74 percent), probably because many jurisdictions mandate the installation of detectors in multifamily dwellings. From 1990 to 1994, there was only a 1 percent increase in the presence of detectors in houses but an 8 percent increase in apartments.

Smoke detectors are much less likely to be present when there are fatalities. Detectors do indeed make a difference. Yet in 19 percent of the reported residential fire deaths in 1994, a detector did operate; in 1988, it was 9 percent. In some cases, the detector may have gone off too late to help the victim, or the victim may have been too incapacitated to react. But the percentage of deaths with detectors present, especially the upward trend, is somewhat disturbing since there is widespread belief than an operating detector will save lives. Further study is needed to show what other factors were involved in these deaths.

[2] The percentages discussed throughout this chapter have been adjusted to apportion the "unknowns" across the other categories.

Sprinklers are not installed in enough residences (3 percent) or apartments (6 percent) to provide meaningful insight. Sprinklers are more prevalent in hotels/motels and business, often mandated by local laws. What is not known is the portion of fires that are unreported as a result of a functioning sprinkler.

RESIDENTIAL PROPERTIES

The leading three causes of residential fires in 1994 were cooking, heating, and arson, as shown in Figure 7. This is the same ranking as reported in 1990. Cooking has been the leading cause of fires in most years, except in the 1970s when heating became the leading cause due to a surge in the use of alternative space heaters and wood heating.

Heating fires include those where the equipment involved in ignition is central heating, fireplaces, portable space heaters, fixed-room heaters, wood stoves, and water heating. The central and water heating portions of the problem have remained relatively steady over the years, while the portable space heater and wood burning stove portions of the problem, along with chimney fires, rose very sharply from the late 1970s to the early 1980s and then subsided somewhat. Although heating is the second leading cause of fires nationally, it leads cooking as the leading cause in one- and two-family dwellings both because these structures predominate in alternative heating sources and because maintenance of heating systems is handled by the homeowner rather than professionals. Heating-related fires are also the second leading cause of fire deaths and dollar loss in residences.

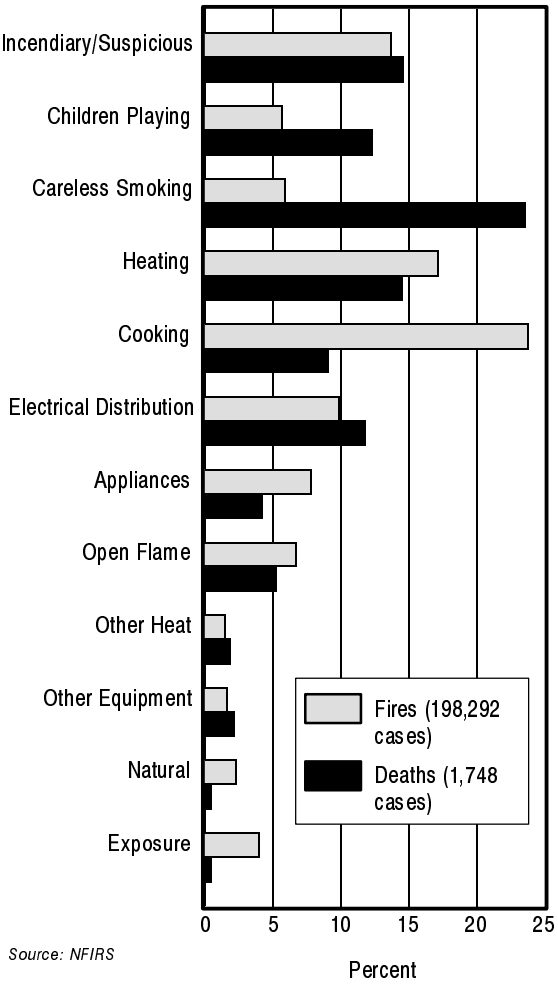


Figure 7. Causes of 1994 Residential Fires and Fire Deaths (Adjusted)

As in all years, careless smoking continued in 1994 to be the leading cause of residential fire fatalities, followed by heating and arson. The relative magnitude of the major causes of residential fire deaths has changed somewhat over time. Deaths from careless smoking have dropped significantly (48 percent) over the 10 years. Nevertheless, one of every four fire deaths in residences is caused by careless smoking. Heating deaths peaked in 1985 but have since fallen 52 percent, moving it from second to third

place. Arson has been the second leading cause of deaths since 1986. This upward trend continued until 1994, when there was a considerable decline in the number of deaths (from 570 deaths to 503). Children playing deaths dropped from 1988 to 1990 but has trended upward since then.

As in all years, cooking was the leading cause of fire injuries by a two to one margin. Most cooking fires come from unattended cooking rather than from equipment failures. Another significant cause of cooking injuries is the ignition of loose clothing such as bathrobes. Greater public awareness of these problems, coupled with information about how to quickly extinguish a cooking fire, could reduce the incidence of such injuries.

Fire deaths usually occur late at night. Nearly 50 percent of the deaths in 1994 (as in 1990) occurred in fires reported from 11:00 p.m. to 6:00 a.m. Many people are overcome in their sleep or wake up too late or too confused to escape. Fire incidence, on the other hand, peaks at 5:00 to 7:00 p.m. from the surge in cooking-related fires during the dinner period. By season, residential fires and fire deaths are most frequent during the winter when heating is a dominant cause and added to the level of year-round causes such as cooking. The residential fire rate in January is almost twice that of summer months, and the fire death rate in January is triple that of summer months.

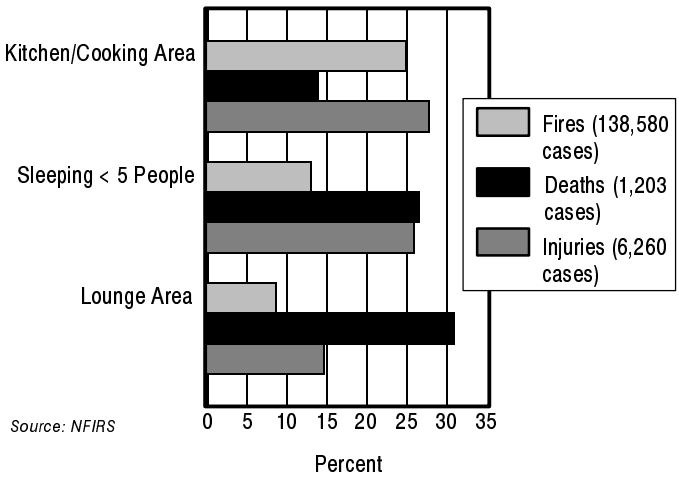


Figure 8. Leading Rooms of Origin of 1994 One- and Two-Family Dwelling Fires and Fire Casualties (Adjusted)

The area of the home (in one- and two-family dwellings) where fires and fire injuries are most common in 1994 is the kitchen, with 25 and 28 percent, respectively (Figure 8). The second most common area for both fires and injuries is the bedroom (13 and 26 percent, respectively), where children playing, careless smoking, and intentionally set fires are the three most frequent fire causes. The third most common location for fires is the chimney (10 percent), usually because it has not been cleaned often enough or well enough (not shown because casualties from chimney fires are not large). The largest number of deaths (31 percent) occur in living rooms, family rooms, and dens; here, careless smoking is a major cause as people doze off with lighted cigarettes. This profile of fires and casualties by room is very similar to that of the preceding several years.

NON-RESIDENTIAL PROPERTIES

Non-residential properties include industrial and commercial properties, institutions, educational establishments, vacant and under construction properties, and mobile properties. Because these categories each have quite different profiles, they are examined separately.

Structures

Fire prevention efforts have focused on protecting non-residential structures and the results have been successful to a large degree. These structures accounted for 9–10 percent of all fires, 5–6 percent of fire deaths, 13–14 percent of injuries, and 32–46 percent of dollar loss. In 1994, total deaths were at a 10-year low.

Figure 9 shows the relative magnitudes of the fire problem (fires and deaths) for the non-residential property category. Half of all deaths were in the storage facility, institution, and manufacturing plant categories—the leading three property types for deaths. Fires in non-residential structures are highest from noon to 8 p.m., which correspond to the times that they are open for business and when workers may be tiring and more accident prone. There are no clear peaks for day of the week or month of year for fires in non-residential structures.

Figure 10 shows that the leading cause of non-residential fires in 1994 is arson. Arson has been the leading cause of non-residential fire deaths for 8 of the past 10 years; in 1988 and 1994, careless smoking was the leading cause of deaths. Arson is also the leading cause of fire injuries.

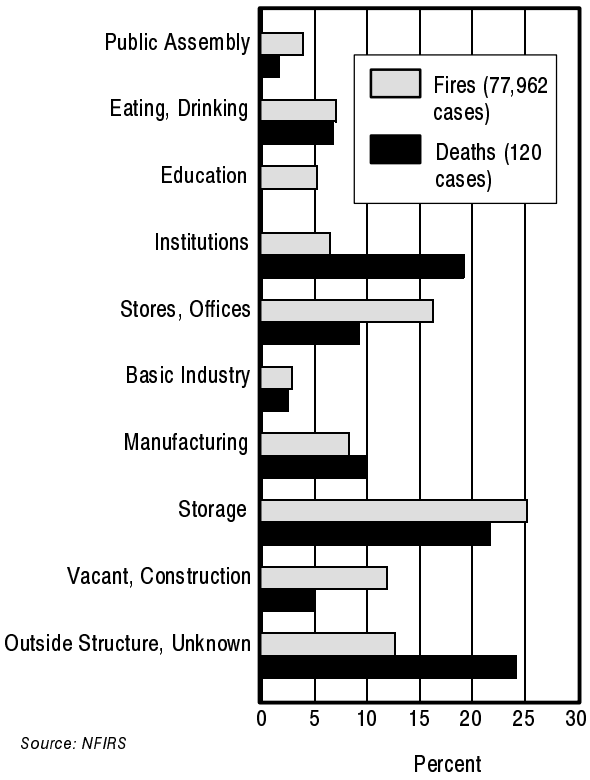


Figure 9. 1994 Non-Residential Fires and Deaths by Property Type

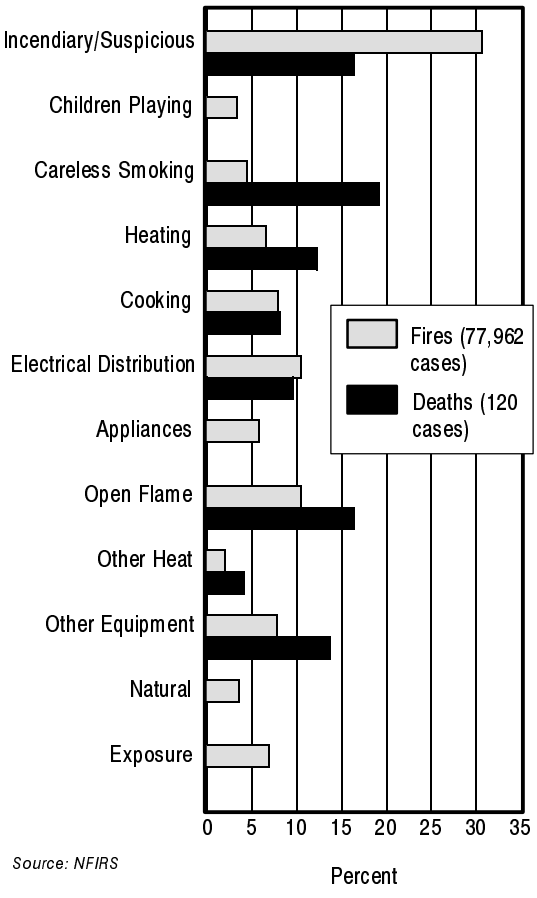
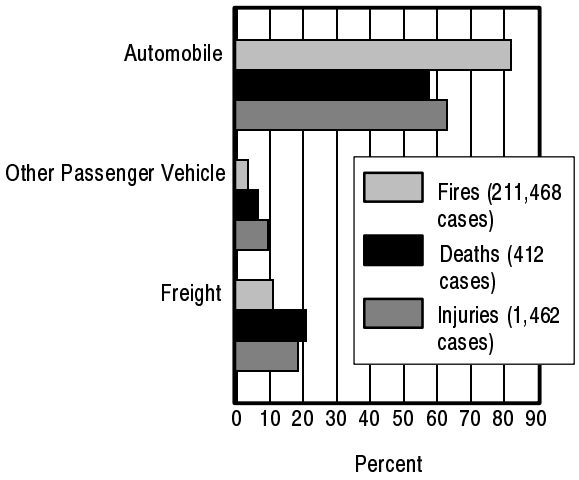


Figure 10. Causes of 1994 Non-Residential Fires and Fire Deaths (Adjusted)

Vehicles

About one in four fires attended by the fire service involves vehicles, mainly cars and trucks. In 1994, the fire service responded to more vehicle fires than to residential fires. And this does not include the tens of thousands of fire department responses to vehicle accidents in which there was no fire.

Vehicles accounted for 17 percent of fire deaths reported to NFIRS, 10 percent of the injuries, and 13 percent of the dollar loss in 1994. The exact number of vehicle fire deaths is uncertain because of the difficulty in determining whether the impact of the accident or the subsequent fire was the cause of death in many cases. The 10-year trend in vehicle casualties has decreased steadily, perhaps due to better safety features that are being built into automobiles. However, there is no doubt that vehicles comprise a much larger segment of the fire problem than most people realize. Vehicle accidents merit more attention in fire prevention than they now receive.



Note: Other mobile property types account for less than 4 percent of the total.

Source: NFIRS

Figure 11. 1994 Mobile Property Fires and Casualties by Major Property Type (Adjusted)

There are nearly eight times more fires associated with automobiles than with trucks (freight). However, truck fires account for a far higher proportion of deaths (one truck death for each three automobile deaths) (Figure 11).

Fires of incendiary or suspicious origin account for about one out of six mobile property fires, but may well be understated because many vehicle fires are not investigated as to cause.

Most vehicle fire deaths (63 percent in 1994) follow collisions, where preventive actions may or may not have been possible. Most of the total fires and personal injuries, however, are a result of mechanical or design problems. The overall vehicle fire loss problem is large enough to warrant adding vehicle fire prevention and possibly even accident prevention to other fire service public education programs.

Outside Properties

Outside fires (fires outside of structures other than vehicle) represent 44 percent of all fires in 1994 (about the same as in 1990). The 800,000 to 1 million outside fires to which fire departments respond represent a significant burden to the fire service. Although this category of property accounts for the highest number of fires, it represents the least amount of deaths (3 percent), injuries (4 percent), and dollar loss (3 percent). These numbers may not reflect the true nature of the problem because of underreporting, the difficulty in setting a price tag on outside fires, and the fact that many wildland fires are not reported to NFIRS or the NFPA annual survey.

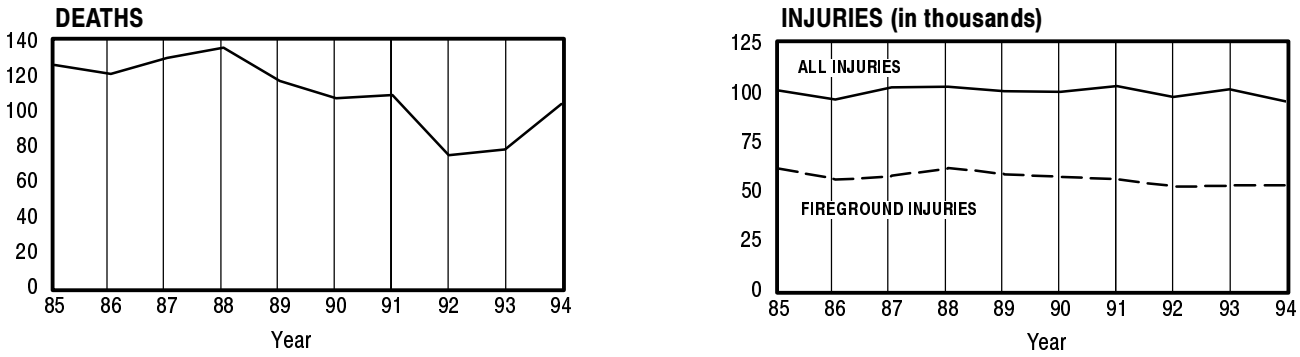
This report examined the wildland fire problem in some detail. As urban areas continue to expand into rural and wilderness areas (called the "interface" area), the problem of fire is receiving greater attention. There has arisen a conflict between foresters, who recommend a "prescribed-burn" policy (burning within limits) in forests to remove the buildup of fuels on the forest floor, and the newly arrived populace, who are concerned about the safety of their homes and gardens. Also, as the population expands to the interface area, they may bring with them a perception that, as is the case in urban areas, local fire departments are capable of handling virtually all of the fires that occur. The reality is that the interface area presents a different set of risks than is usually faced by urban departments. The challenge is to better balance fire resources, public expectations, and prevention/mitigation efforts (e.g., better home construction and landscaping techniques) in interface areas.

FIREFIGHTER DEATHS AND INJURIES

Over the period 1985 to 1994, there has been a significant downward trend in firefighter deaths per year. A closer examination of this trend, however, shows that after a steady decline in firefighter deaths from 1988 to 1992, there has been a sharp increase in deaths—from 75 in 1992 to 104 in 1994 (Figure 12). The 1994 total includes the tragedy in which 14 firefighters were killed on Storm King Mountain in Colorado. But even if this major incident were excluded, the number of firefighter deaths increased significantly in 1994. In 1994, 78 percent of all firefighter deaths were at residential and wildland fires.

The number of firefighter injuries has changed little over the 10-year period. They averaged 100,000 per year. About 53 percent of the firefighter injuries were on the fireground. Of the firefighter injuries associated with fires, 58 percent occurred at residential fires and 25 percent at non-residential structural fires.

More firefighters get injured outside the fire building than inside. The torso, arms and hands, and legs and feet are about equally distributed as the body areas most often injured. Firefighter injuries are spread over the day, throughout the year, and across various age groups. They peak at night, in the winter, and between ages



Sources: NFPA Annual Surveys and the United States Fire Administration

Figure 12. Trends in 1994 Firefighter Casualties

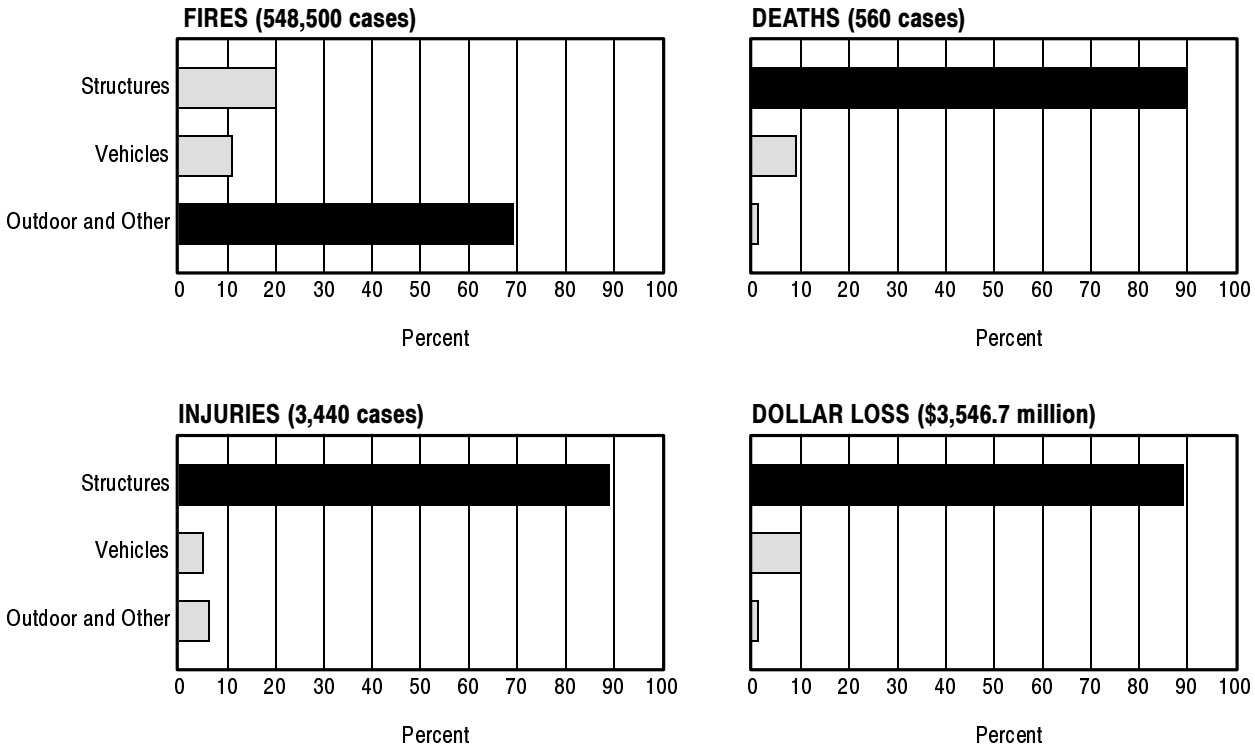
30–34. Local fire departments should consider their own profile of injuries and the reasons for any peaks in the profiles.

ARSON

Arson continues to be a pervasive problem affecting many of the major types of properties. It is the leading cause of total fires and dollar losses, primarily because it accounts for a heavy portion of loss in non-residential structures and outside properties. Annual direct cost of arson reported by the fire services is almost $3.6 billion. The true total is undoubtedly higher. Except for a spike in 1992, reported arson losses have remained somewhat steady over the 1985–1994 period. Arson is also the second leading cause of residential fire deaths and the third leading cause of fires in residences.

Arson is by far a more acute problem in urban areas than in rural locales. A 1995 study by the National Fire Protection Association shows that from 1990 to 1994, the rate for arson fires in cities of 250,000 or more was greater than twice the rate for communities of under 25,000.

In 1994, 20 percent of all arson fires occurred in structures, but these fires alone accounted for about 90 percent of all fire deaths, injuries, and dollar losses (Figure 13). But 69 percent of all arson fires are outdoor fires that cause few deaths and injuries and have relatively little impact on total dollar loss. Outdoor arson fires, however, are cause for concern because they can easily spread to structures. Although the 10-year trend for arson fires has gone down, arson is decreasing at a slower rate in residential structures than in non-residential structures. This is an important trend to watch given that more deaths and higher losses are associated with residential structures than in non-residential or commercial structures.



Sources: NFIRS and NFPA Annual Surveys

Figure 13. 1994 Arson Fires and Fire Losses by Major Occupancy Type

The NFPA reports that in 1994, for the first time, juvenile firesetters accounted for a majority of those who were arrested on arson charges. This growing problem is cause for serious concern and deserves more attention from policymakers.

The motives of the firesetter include vandalism, spite, revenge, intimidation, concealment of a crime, economic factors, and emotional/psychological dysfunctions. NFIRS collects data on the cause of fires, but more detailed data need to be collected on the motives of the arsonist in order to have a more complete picture of the arson problem. Furthermore, as fire investigation budgets have been reduced, many arson fires are not identified as such nor do they get fully investigated. Without thorough investigations and the willingness of local prosecutors to pursue cases against suspected arsonists, it will be difficult to make headway in the effort to reduce the incidence of arson fires in the United States.

TOTAL COST OF FIRE

The true cost of fire in the United States is much greater than just the value of property destroyed by fire—in the range of $92 to $139 billion (Table 1). The total cost includes the cost of fire services; the cost of fire protection built into buildings and equipment; the cost of fire insurance overhead; the many indirect costs, such as business interruptions, medical expenses, and temporary lodging; the value to society of the injuries and deaths caused by fire; the cost of government and private fire-related organizations; and the myriad of other related costs that add up to a very large economic impact.

Table 1. Summary of Total Cost of Fire

Cost Component	Range of Cost Estimates ($ billions)	Most Likely Estimate ($ billions)
Category A: Losses		
Residential Property	4.0	4.0
Industrial Property	4.2	4.2
Other Property	0.7	0.7
Residential Interruption	0.6–1.0	0.8
Business Interruption	6.1–8.4	8.4
Product Liability	3.5	3.5
Category B: Insurance		
Product Liability	0.1	0.1
Net Fire Insurance	5.6	5.6
Category C: Fire Service		
Paid	9.6	9.6
Volunteer Conversion	16.2–36.8	30.0
Category D: Preventative		
Built into Structures	20.7	20.7
Built into Equipment	13.5–22.5	18.0
Standards Activity	0.1–0.6	0.2
Retardants/Testing	1.9–4.0	2.5
Fire Maintenance	4.3–16.6	6.5
Disaster Recovery	0.6	0.6
Total	91.7–138.9	115.4

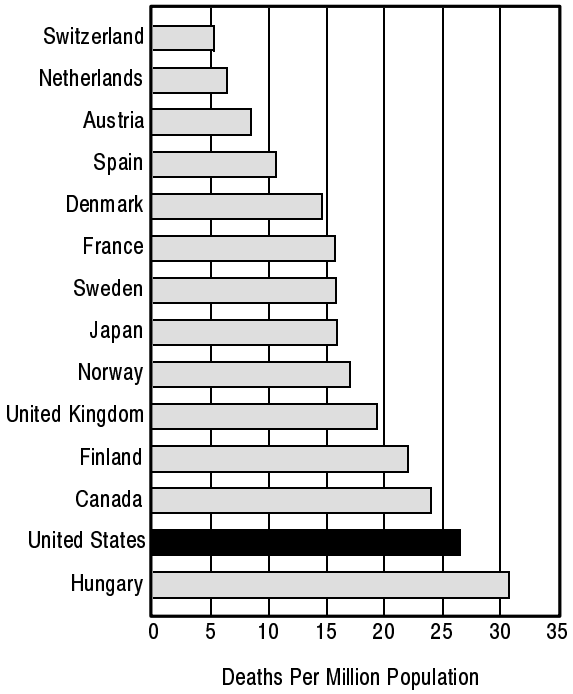
Source: William Meade, *A First Pass at Computing the Cost of Fire in a Modern Society*, The Herndon Group, March 1991; prepared for Center for Fire Research, National Institute of Standards and Technology, Gaithersburg, Maryland.

Because the cost of fire is perhaps 6 to 12 times higher than the direct losses alone, fire protection ranks among the larger national problems in terms of its economic impact. The full magnitude of the problem is probably underappreciated by the general public, media, and elected officials. The total cost is important to estimate when considering priorities across programs. Analysis of changes in incremental costs of the major components of the total cost of fire should be given more consideration in setting priorities than it is usually is.

U.S. FIRE VERSUS INTERNATIONAL FIRE PROBLEM

The United States historically has had one of the highest fire loss rates of the industrialized world in terms of both fire deaths and dollars loss. The fire death rates for 13 industrialized nations were compared with those in the United States. Although comparisons of total fires and total fire losses would be preferable, reliable data are not available due to diverse record keeping and fire classification practices in different countries.

Figure 14 depicts the average per capita fire death rates for 14 industrialized nations from 1979 to 1992. This figure demonstrates that the United States ranked only behind Hungary as having the highest per capita fire death rate. At a rate of 26.5 deaths per million population, the United States' fire death rate was more than five times that of Switzerland, which had the lowest rate of all the countries considered—5.2 deaths per million population.



Source: World Fire Statistics Centre

Figure 14. Average Fire Death Rate by Country (1979–92)

Although the situation in the United States improved greatly between 1979 and 1992, the declining trend was international in scope. Of the countries considered, only Hungary and Denmark recorded increases in their fire death rates over that period. But the reduction of the fire death rate for the United States (46 percent, or 16.8 fire deaths per million population) was the largest absolute and relative drop of any of the countries shown.

Many people feel that there is little reason for the United States, which possesses a wealth of advanced fire suppression technologies and fire service delivery mechanisms, to lag so far behind other nations in terms of fire safety. However, most of the advanced fire technology used in the United States is installed in public places and most fire deaths occur in the home. Although statistical data are not available, the United States is widely believed to have many more residential fires on a per capita basis than the other countries studied. This higher fire rate, as well as the United States' higher fire death rates, is likely a product of several factors:

- The United States commits fewer resources, both in terms of dollars and staff time, to fire prevention activities than other industrialized countries.
- There is greater tolerance in the United States for "accidental" fires.

- Whether through ignorance or a false sense of confidence, Americans practice riskier and more careless behavior than people in other countries.

In sum, industrialized countries in Europe and Asia can provide the United States with valuable lessons on reducing the incidence of residential fires and residential fire deaths through fire prevention.

1

INTRODUCTION

The United States continues to have one of the most severe fire problems in the world relative to its population size. Most Americans are not aware of this nor of the nature of the fire problem.

This report is a statistical portrait of the fire problem in the United States over the period 1985--94. It is intended for use by a wide audience, including the fire service, the media, researchers, industry, government agencies, and interested citizens. The report focuses on the national fire problem. The magnitude and trends of the fire problem, the causes of fires, where they occur, and who gets hurt are topics that are emphasized. One specific focus is on firefighter casualties—causes, types of injuries, etc.

This document represents the sixth major edition of *Fire in the United States* published by the U.S. Fire Administration: the First Edition, published in 1978, covered 1975--76 fire data; the Second Edition, published in 1982, covered 1977--78; the Sixth Edition, published in 1987, covered 1983; the Seventh Edition, published in 1990, covered 1983--87; the Eighth Edition, published in 1991, covered 1983--90; and this Ninth Edition covers 1985--94. There were also three editions—the Third, Fourth, and Fifth—produced and used as working papers though not published.

This Ninth Edition builds on the previous edition by adding 4 years of new data. Trends and comparisons, therefore, cross a 10-year span, while profiles of causes, occurrences, age groups, sexes, and other meaningful factors are shown for 1994. Where appropriate, comparisons are made with the previous 1990 edition.

SOURCES

The report is primarily based on the National Fire Incident Reporting System (NFIRS) data, but uses other sources as well, especially the National Fire Protection Association's (NFPA's) annual survey of fire departments.

National Fire Incident Reporting System

The National Fire Incident Reporting System was started in 1975 as one of the first programs of the National Fire Prevention and Control Administration, which later became the U.S. Fire Administration (USFA). The basic concept of NFIRS has not changed since the system's inception. All states and all fire departments within them have been invited to participate on a voluntary basis. Participating fire departments collect a common core of information on fire and casualty reports

using a common set of definitions. The data may be written by hand on paper forms or keyed in using computer terminals. Fire departments send these data either as a bundle of paper reports or on a computer tape to their state fire data office, which edits and collates the data. Semiannually or annually, the state's data are sent to the U.S. Fire Administration. There, the data are further validated. Data summaries and error reports may be sent back to the states to correct suspicious, incorrect, or incomplete information. Data on individual fire incidents and casualties are preserved incident by incident at local, state, and national levels.

The system has gradually grown from an initial 6 states in 1976 to 40 states and the District of Columbia in 1994. Table 2 lists the participating states over the 1985 to 1994 period. More than 25,000 fire departments provide data to the system, with more than half of these reporting to NFIRS (Table 3). Some states require their departments to participate. The future goal is voluntary participation by all states and the District of Columbia.

Corresponding to the increased participation, the number of fires, deaths, and injuries and the amount of dollar loss reported to NFIRS also grew considerably from 1975 to 1994. In 1994, over 896,000 fire incidents were collected, about 44 percent of the estimated total attended by fire departments.

There are, of course, many problems in assembling a real-world database, and NFIRS is no exception. But the enormous sample size and good efforts by the fire service allow a tremendous amount of useful information to be collected and used. Because of the enormous advances in computer technology over the past 20 years, plans for revision to NFIRS are presented in Appendix C.

Uses of NFIRS

The NFIRS data are used extensively for major fire protection decisions. At the federal level, for example, the Consumer Product Safety Commission uses the data to identify problem products and to monitor corrective actions. The Department of Transportation has used these data to identify car fire problems and has ordered recalls triggered by NFIRS data. The Department of Housing and Urban Development uses NFIRS to evaluate safety of manufactured housing (mobile homes). And of course the U.S. Fire Administration uses the data to design prevention programs, to order firefighter safety priorities, and for a host of other purposes. Thousands of fire departments, scores of states, and hundreds of industries have used the data. The potential for even greater use remains. One of the purposes of this report is to give some idea of the types of information available from NFIRS. The information here is highly summarized; much more detail is available.

Table 2. States Participating in NFIRS, 1985–1994

State	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Alabama	X	X	X	X	X	X	X	X	X	X
Alaska	X	X	X	X	X	X	X	X	X	X
Arizona	X	X	X	X	X	X			X	X
Arkansas	X	X	X	X	X	X	X	X	X	X
California	X	X	X	X	X	X	X	X	X	X
Colorado	X	X		X	X	X	X	X	X	X
Connecticut	X	X	X	X	X	X	X	X	X	X
Delaware	X	X	X	X	X	X				
District of Columbia	X	X	X		X		X	X	X	X
Florida	X	X	X	X	X	X	X	X	X	X
Georgia					X	X	X	X	X	X
Hawaii	X	X	X	X	X	X	X	X		
Idaho		X	X	X	X	X	X	X	X	X
Illinois	X	X	X	X	X	X	X	X	X	X
Indiana		X	X	X	X	X	X	X	X	
Iowa	X	X	X	X	X	X	X	X	X	X
Kansas	X	X	X	X	X	X	X	X	X	X
Kentucky	X	X	X	X	X	X	X	X	X	X
Louisiana	X	X	X	X	X	X	X	X	X	X
Maine	X	X	X	X	X	X				
Maryland	X	X	X	X	X	X	X	X	X	X
Massachusetts	X	X	X	X	X	X	X	X	X	X
Michigan	X	X	X	X	X	X	X	X	X	X
Minnesota	X	X	X	X	X	X	X	X	X	X
Mississippi										
Missouri										
Montana	X	X	X	X	X	X	X	X	X	X
Nebraska	X	X	X	X	X	X	X	X	X	X
Nevada										
New Hampshire	X	X	X	X	X	X	X	X	X	X
New Jersey	X	X	X	X	X	X	X	X	X	X
New Mexico										X
New York	X	X	X	X	X	X	X	X	X	X
North Carolina	X									
North Dakota										
Ohio	X	X	X	X	X	X	X	X	X	X
Oklahoma							X	X	X	X
Oregon	X	X	X	X	X	X	X	X	X	X
Pennsylvania										
Rhode Island	X	X	X	X	X	X	X	X	X	X
South Carolina	X	X	X	X	X	X	X	X	X	X
South Dakota	X	X	X	X	X	X	X	X	X	X
Tennessee	X	X	X	X	X	X	X	X	X	X
Texas	X	X	X	X	X	X	X	X	X	X
Utah	X	X	X	X	X	X	X	X	X	X
Vermont	X	X	X	X	X	X	X	X	X	X
Virginia	X	X	X	X	X	X	X	X	X	X
Washington	X	X	X	X	X		X	X	X	X
West Virginia	X	X	X	X	X	X	X	X	X	X
Wisconsin	X	X	X	X	X	X	X		X	X
Wyoming		X	X	X	X	X	X	X	X	X
Total	40	42	41	41	43	41	41	40	41	41

Table 3. Fire Departments Reporting to NFIRS—1994

Participating State	No. of Participating Fire Departments	No. of Fire Departments in State	Fire Departments Reporting (percent)
Alabama	1	1,072	0.1
Alaska	78	253	31
Arizona	5	258	2
Arkansas	355	824	43
California	373	1,153	32
Colorado	25	400	6
Connecticut	215	274	78
District of Columbia	1	1	100
Florida	330	674	49
Georgia	151	718	21
Idaho	157	214	73
Illinois	884	1,330	66
Iowa	539	869	62
Kansas	557	674	83
Kentucky	474	794	60
Louisiana	376	700	54
Maryland	355	370	96
Massachusetts	326	364	90
Michigan	925	1,030	90
Minnesota	650	821	79
Montana	208	551	38
Nebraska	299	483	62
New Hampshire	85	253	34
New Jersey	385	788	49
New Mexico	1	359	0.3
New York	1,647	1,809	91
Ohio	906	1,300	70
Oklahoma	504	857	59
Oregon	329	325	101
Rhode Island	45	81	56
South Carolina	157	655	24
South Dakota	221	343	64
Tennessee	189	655	29
Texas	526	2,000	26
Utah	121	211	57
Vermont	113	252	45
Virginia	438	702	62
Washington	53	655	8
West Virginia	428	442	97
Wisconsin	222	901	25
Wyoming	109	252	43
Total	13,763	26,667	52

NFPA and Other Data Sources

In addition to NFIRS, this report makes use of the summary numbers for fires, deaths, injuries, and dollar loss from the National Fire Protection Association's (NFPA) annual survey of fire departments and NFPA *Fire Command* articles on firefighter casualties. It also uses data obtained from state fire marshals, the National Center for Health Statistics, the Bureau of the Census, and the Consumer Product Safety Commission. The U.S. Fire Administration gratefully acknowledges the use of their information. Sources are cited for each graph and table in the report.[1]

METHODOLOGY

An attempt was made to keep the data presentation and analysis as straightforward as possible. It was also the desire of the USFA to make the report accessible to the largest group of users, and therefore an attempt was made to avoid any unnecessarily complex methodology.

National Estimates

Most numbers in this report are national estimates or percentages, not raw totals from NFIRS. The reader does not have to scale the data.

Many of the estimates are derived by computing a percentage from NFIRS and multiplying it by the total number of fires, deaths, injuries, or dollar loss from the NFPA annual survey. For example, the national estimate for the number of residential cooking fires was computed by taking the percentage of NFIRS residential fires (with known causes) that were attributed to cooking and multiplying it by the estimated total number of residential fires from the NFPA survey.

Ideally, one would like to have all of the data come from one self-consistent data source. But because the "residential population protected" was not reported to NFIRS by many fire departments and the reliability of that data element is suspect in many other cases, especially where a county is served by several fire departments which each report their population protected independently, this data element was not used. Instead, the extrapolation of the NFIRS sample to national estimates was made using the NFPA survey for the gross totals of fires, deaths, injuries, and dollar loss.

One problem with this approach is that the proportions of residential, non-residential, mobile property, and outside fires and fire deaths differ between the large NFIRS sample and the NFPA survey sample. For example, in NFIRS, residential fire injuries in 1994 comprise 68 percent of the total, versus 73 percent in the NFPA survey. Mobile property (mostly motor vehicles) deaths in 1994 are 17 percent in NFIRS and 15 percent in NFPA. To be consistent with approaches being used by the Consumer Products Safety Commission and NFPA, we have used the NFPA estimates of fires, deaths, injuries, and dollar loss for residential, non-residential, mobile, and outside properties as a

[1] The term *fire losses* in captions refers to deaths, injuries, and dollar loss; the term *fire casualties* refers to deaths and injuries.

starting point. The details of the national fire problem below this level are based on proportions from NFIRS. One will not get the same numbers starting from the NFIRS proportions of residential, non-residential, etc., as from the NFPA proportions. This inconsistency will remain until all estimates can be derived from NFIRS alone.

In the future, the national estimates will be derivable solely from NFIRS if a statistically sufficient number of fire departments participating in NFIRS provide reasonably accurate estimates of their population protected.

Unknowns

On a fraction of the incident reports or casualty reports sent to NFIRS, the desired information for many data items is either left blank or reported as "unknown." The total number of blank or "unknown" entries is often larger than some of the important subcategories. For example, 44 percent of the fires in 1994 do not have sufficient data reported to NFIRS to determine cause. The lack of data, especially for fatal fires, masks the true picture of the fire problem. Many prevention and public education programs use the NFIRS data to target at-risk groups or to address critical problems, fire officials use the data in decisionmaking that affects the allocation of firefighting resources, and consumer groups and litigators use the data to assess product fire incidence. When the unknowns are large, the credibility of the data suffers. Fire departments need to be more aware of the effect of incomplete reporting.

Adjusted Percentages

In making national estimates, the unknowns should not be ignored. The approach taken in this report is to provide not only the "raw" percentages of each category, but also the "adjusted" percentages computed using only those incidents for which the cause was provided. This in effect distributes the fires for which the cause is unknown in the same proportion as the fires for which the cause is known, which may or may not be approximately right. That is the best we can do without additional knowledge of the nature of the unknowns.

To illustrate: Heating was reported as the fire cause for 9.8 percent of residential fire fatalities; another 32.6 percent of residential fatalities had cause unknown; thus, the percent of fatalities that had their cause reported was 100 - - 32.6 = 67.4 percent. With the unknown causes proportioned like the known causes, the adjusted percent of residential fire fatalities caused by heating can then be computed as $9.8 \div 67.4 = 14.5$ percent.

Representativeness of the Sample

The percentage of fire departments participating in NFIRS varies state to state, and some states are not participating at all. To the best that USFA can determine, the distribution of participants is at least reasonably representative of the entire nation, even though the sample is not random. The

sample is so large—over 40 percent of all fires—and so well distributed geographically and by size of community that there is no known major bias that will affect the results. Most of the NFIRS data exhibit stability from one year to another, without radical changes, as will be observed from the 10-year trend lines presented throughout this report. Also, results based on the full data set are generally similar to those based on part of the data, another indication of data reliability. Although the individual incident reports could and should be filled out more completely and more accurately than they are today—as can be said about most real-world data collections as large as NFIRS—the "big picture" is a reasonably accurate description of the fire problem in the United States. It is the best one we have ever had.

Trend Data

A frequently asked question is how much a particular aspect of the fire problem has changed over time. The usual response is in terms of a percentage change from one year to another. As we are dealing with real-world data that fluctuate from year to year, a percent change from one specific year to another can be misleading. This is especially true when the beginning and ending data points are extremes—either high or low. For example, in Figure 15, "Trends in Fires and Fire Losses," the percent change from 1985 of 28,425 injuries to 1994 of 27,250 injuries would be a decrease of 4 percent. Yet, if we were to choose 1986 as the beginning data point (26,826 injuries), this change would be show a 1.6 percent increase. As we are interested in *trends* in the U.S. fire problem, this edition of *Fire in the United States* reports the overall change in a data series as a trend. We have computed the best-fit trend line (which accounts for the fluctuation in the year-to-year data) and have presented the change over time based on this trend line. In this example, the overall 10-year trend is an increase in injuries of 2.6 percent—not the 4 percent decrease calculated from only beginning and ending years.

Cause Categories

The causes of fires are often a complex chain of events. To make it easier to grasp the "big picture," 13 major categories of fire causes such as heating, cooking, and children playing are used by the U.S. Fire Administration here and in many other reports. The alternative is to present scores of detailed cause categories or scenarios, each of which would have a relatively small percentage of fires. For example, "heating" includes subcategories such as misuse of portable space heaters, wood stove chimney fires, and fires involving gas central heating systems. Experience has shown that the larger categories are useful for an initial presentation of the fire problem. It then can be followed by more detailed analysis, as needed.

The cause categories used in this project are listed in the same order on each graph to make comparisons easier from one to another. The order here also is the same as used in previous *Fire in the United States* reports. The particular order chosen was a combination of the order used in the cause sorting hierarchy and a desire to put the more important causes in the top half of the charts.

A problem to keep in mind when considering the rank order of causes in this report is that sufficient data to categorize the cause were not reported to NFIRS for 40 percent of the fatal fires in the database. The rank order of causes might be different than shown here if the cause profile for the fires whose causes were not reported to NFIRS were substantially different from the profile for the fires whose causes was reported. However, there is no information to indicate that there is a major difference between the knowns and the unknowns, and so our present best estimate of fire causes is based on the distribution of the fires with known causes.

Fires are assigned to one of the 13 general cause groupings using a hierarchy of definitions, approximately as shown in Table 4.[2] A fire is included in the highest category into which it fits on the list. If it does not fit the top category, then the second one is considered, and if not that one, the third, and so on. For example, a fire caused by an arsonist using a match to ignite a fuse is included in the "incendiary or suspicious" category and not in the "open flame" category. If the arsonist used a cigarette to ignite the fuse, the fire still is grouped with incendiary and suspicious fires and not with "careless smoking" fires.

The NFIRS fire data can be analyzed in many ways such as by the form of the heat of ignition, the material ignited, the ignition factor, or many other groupings. The hierarchy used in this report has proved useful in understanding the fire problem and targeting prevention, but other approaches are certainly useful too. Because the NFIRS database stores records fire by fire and not just in summary statistics, a very wide variety of analyses are possible.

Ratio of NFIRS to NFPA Data

There is an inconsistency between the NFIRS sample and the NFPA annual survey data: In every year, the deaths reported to NFIRS are a larger fraction of the NFPA estimate of deaths than the NFIRS fires are of the NFPA estimate of fires. NFIRS injuries and dollar loss are even larger fractions of the NFPA totals than are deaths or fires. This issue is discussed further in Appendix A.

Unreported Fires

NFIRS only includes fires to which the fire service was called. In some states, fires attended by state fire agencies (such as forestry) are included; in other states, they are not.

NFIRS does not include fires from ten states and many fire departments within participating states. However, if the fires from the reporting departments are reasonably representative, this omission does not cause a problem in making accurate national estimates for any but the smallest subcategories of data.

[2] The exact hierarchy and specific definition in terms of the NFIRS code may be found on pages 2--201 to 2--203 of the 1990 NFIRS System Documentation Manual, Version 4.1. The actual hierarchy involves a large number of subcategories that are later grouped into the 13 major categories.

Table 4. Hierarchy of Cause Groupings Used in This Report

Cause Category*	Definition
Exposure	Caused by heat spreading from another hostile fire
Incendiary/Suspicious	Fire deliberately set or suspicious circumstances
Children Playing	Includes all fires caused by children playing with any materials contained in the categories below
Natural	Caused by Sun's heat, spontaneous ignition, chemicals, lightning, static discharge
Smoking	Cigarettes, cigars, pipes as accidental heat of ignition
Heating	Includes central heating, fixed and portable local heating units, fireplaces and chimneys, water heaters as source of heat
Cooking	Includes stoves, ovens, fixed and portable warming units, deep fat fryers, open grills as source of heat
Electrical Distribution	Includes wiring, transformers, meter boxes, power switching gear, outlets, cords, plugs, lighting fixtures as source of heat
Appliances (including air conditioning/refrigeration)	Includes televisions, radios, phonographs, dryers, washing machines, vacuum cleaners, hand tools, electric blankets, irons, electric razors, can openers, dehumidifiers, water cooling devices, air conditioners, refrigeration equipment as source of heat
Other Equipment	Includes special equipment (radar, x-ray, computer, telephone, transmitters, vending machine, office machine, pumps, printing press), processing equipment (furnace, kiln, other industrial machines), service, maintenance equipment (incinerator, elevator), separate motor or generator, vehicle in a structure, unspecified equipment
Open Flame, Spark (heat from)	Includes torches, candles, matches, lighters, open fire, ember, ash, rekindled fire, backfire from internal combustion engine as source of heat
Other Heat	Includes fireworks, explosives, heat or spark from friction, molten material, hot material, all other fires caused by heat from fuel-powered objects, heat from electrical equipment arcing or overloading, heat from hot objects not covered by above groups
Unknown	Cause of fire undetermined or not reported

* Fires are assigned to a cause category in the hierarchical order shown. For example, if the fire is judged incendiary and a match was used to ignite it, it is classified as incendiary and not open flame, because incendiary is higher on the list. One minor deviation: if the fire involves air conditioning or refrigeration, it is included in appliances and not electrical distribution.

An enormous number of fires are not reported to the fire service at all. Most are small fires in the home or in industry which go out by themselves or are extinguished by the occupant. These unreported fires collectively cause a great deal of property loss and a large number of injuries requiring medical attention, based on a study done in the early 1970s. CPSC commissioned a study in 1984 on unreported fires. We do not have a current study that can be used to estimate the magnitude of the problem.

Perhaps the most disturbing type of unreported fires are those not submitted by fire departments that are participating in NFIRS. Some departments submit information on most but not all of their fires. Sometimes the confusion is systematic, as when no-loss cooking fires or chimney fires are not reported. Sometimes it is inadvertent, such as when incident reports are lost or accidentally not all submitted. The information that is received is assumed to be the total for the department and is extrapolated as if it were. There is no measure of the extent of this problem at present. It does not seem to be large enough to distort the major aspects of the picture, but it needs to be monitored in the future.

ORGANIZATION OF THIS REPORT

This report is organized similarly to the Eighth Edition of *Fire in the United States*. Chapter 2 presents an overview of the national fire problem in terms of the total number of fires, deaths, injuries, and dollar loss—the four principal measures used to describe the fire problem.

Chapters 3 through 5 address residences, non-residences, and firefighter casualties, respectively. Sections within each chapter focus on subsets of the subject (e.g., within residential: one- and two-family dwellings versus apartments, vehicles, motels, etc.). Chapter 6 focuses on special topics bearing on the fire problem, including a comparison of U.S. fire statistics with 13 industrial nations, a close look at the magnitude of the arson and wildland fire problems, and identification of the cost of U.S. fires. At the end of each chapter, a section describes available resources that provide in-depth information on specific topics.

Previous editions of *Fire in the United States* have presented a state-by-state look at residential fires and deaths for 1 year and for a 3-year period. This analysis has been omitted from this edition, but will be published as a separate report in 1997. However, a quick-look, 50-state comparison chart of state fire death rates is available in Chapter 2.

Appendix A discusses the differences between NFPA and NFIRS data.

Most of the data are presented graphically for ease of comprehension. The specific data associated with the graphs are usually provided directly with the graphic. Where the data are too numerous to include in the graphic, data tables are presented in Appendix B.

The National Fire Incident Reporting System, originally designed in 1975, has become outdated and cumbersome by today's standards. Therefore, NFIRS is being redesigned. A summary of the planned changes is presented in Appendix C.

This edition of *Fire in the United States* concludes with an a comprehensive index to the topics of this report.